The impact of climate change on buildings

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A broadly founded PhD study at DTU Civil Engineering will create fundamental new knowledge that can make new buildings in Denmark less sensitive and more adaptable to environmental changes brought on by global warming.

Many European cities have experienced flooding due to heavy precipitation. Photo: Coulorbox.

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Typical damage due to water penetration through basement walls. Photo: Rimante Andrasiunaite Cox.

Global warming and other effects of climate change will inevitably increase in the foreseeable future. Consequently, complementary research is beginning to look at ways of mitigating the effects of global warming.

The PhD project 'Climate change and its impact on lifetime and maintenance of buildings' looks at the possible effects of global warming on the lifetime and maintenance of buildings in Denmark. In particular, it considers threats posed by extreme weather events which are due to become more frequent in the future. Such events include flooding, heat waves, drought and periods of extreme cold.

The project will focus on solutions that not just adapt to climate change but which do not further exacerbate the problem. For example, as average temperatures increase, buildings may consume more energy for cooling. The increased energy demand, if met by fossil fuels, will exacerbate global warming, leading to higher average temperatures. This, in turn, will spur further increases in energy consumption in order to cool the buildings. In this way, a perpetual loop is created in which the immediate solution subsequently makes the problem worse. To avoid this development, it is important to look at how different solutions will work in the present situation, but also how they might work in the future.

Wide-ranging collaboration

The project is a partnership between DTU Civil Engineering, Centre of Facility Management, DTU Management Engineering, Realdania Research Centre and Gentofte Estate, and it is a unique opportunity to work across different research subjects such as building physics and facilities management as well as involving close collaboration with industry. As the project relies on climatology findings, DTU Climate Centre and Denmark's Metrological Institute are also involved. The aim of the project is to examine ways of mitigating the effects of global warming on buildings using three case studies based on historical buildings in Gentofte.

The research will attempt to (i) identify the climate change threats to Denmark in the next 100 years and their impacts on building stocks, (ii) clarify how increased thermal exposure and precipitation cause damage to historical and listed buildings, and (iii) clarify how different passive applications can mitigate these effects on historical buildings. For example, urban vegetation might mitigate the effects of climate change in the built environment? Or how can advanced natural ventilation be adapted to the historical built environment?

Generating new knowledge

The outcomes of the study will include (i) methods of analysing and predicting the effects of global warming on the lifetime and maintenance of buildings in Denmark, (ii) an analysis of methods for mitigating the effects of climate change, (iii) tools (or methods) to support prioritisation of the most cost-effective mitigation strategies relative to the lifetime of the buildings, and (iv) fundamental new knowledge that can be used to make new building codes in Denmark that will be less sensitive and more adaptable to environmental changes brought on by global warming.